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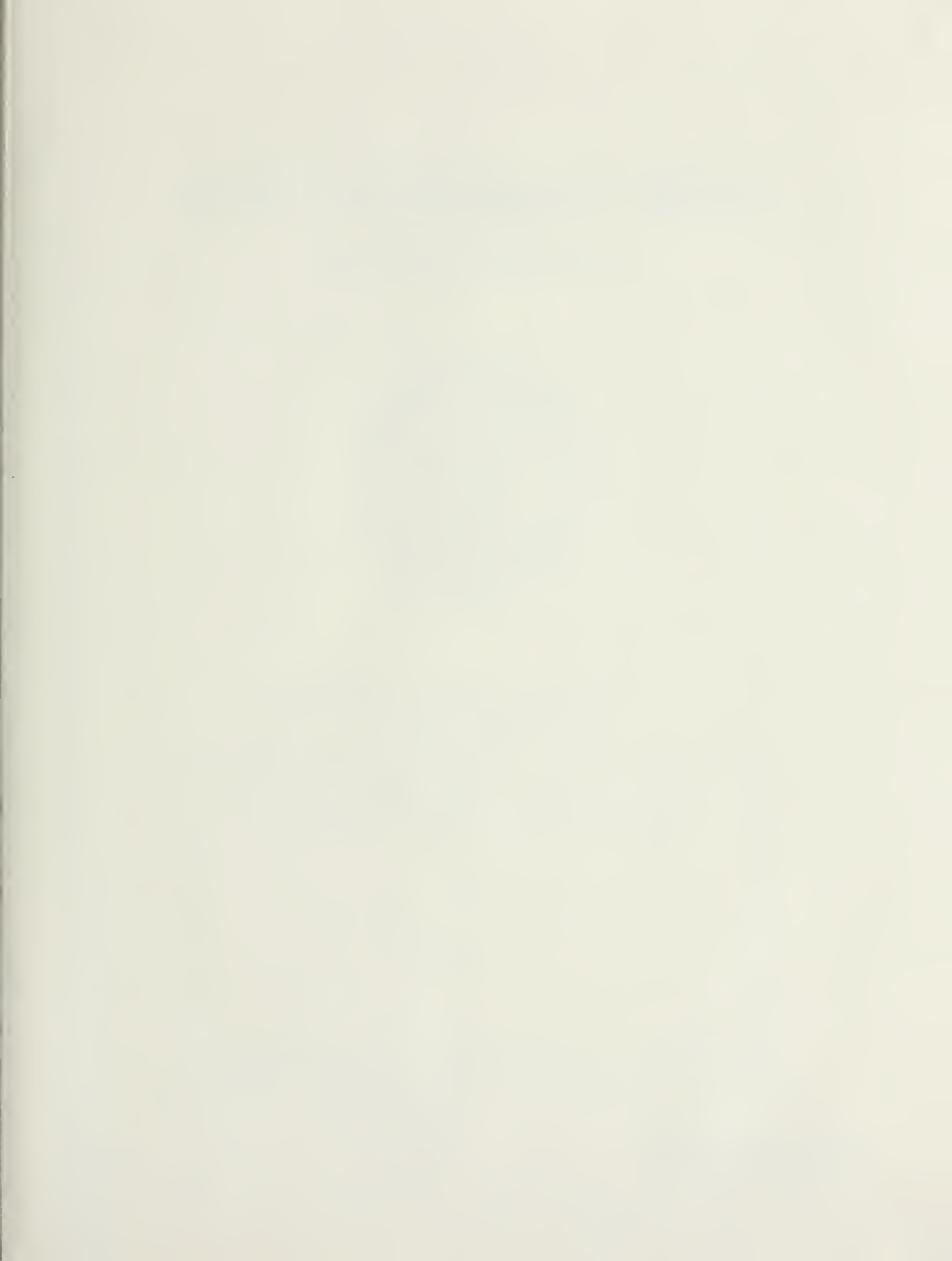


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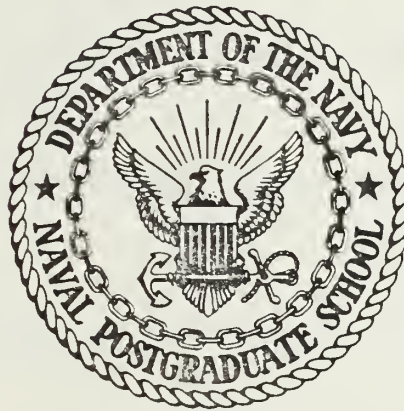
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THESIS

DOCUMENTATION AND ANALYSIS OF THE
"MISCELLANEOUS" ACCOUNT CATEGORY WITHIN THE
DOD INSTRUCTION 7220.29-H DEPOT LEVEL
MAINTENANCE COST ACCOUNTING SYSTEM

by

Steven Eugene Lehr

December 1984

Thesis Advisors: K.J. Euske, S.L. Ansari

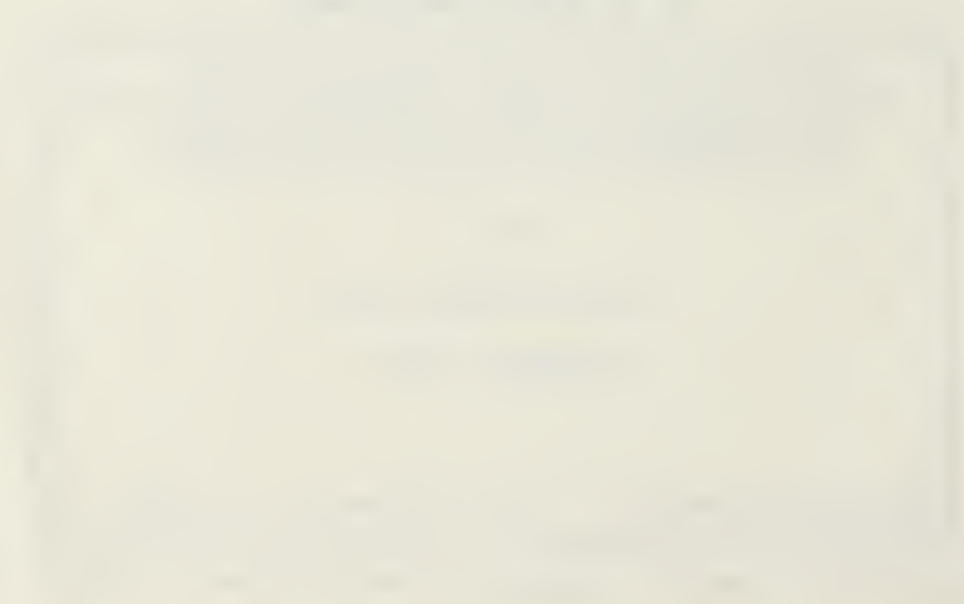
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Documentation and Analysis of
the "Miscellaneous" Account Category within the
DoD Instruction 7220.29-H Depot Level Maintenance Cost Accounting
System

By

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Lieutenant, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

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December 1984

ABSTRACT

The purpose of this research is to examine and document the reasons why more than 40 percent of the fiscal year 1983 depot level repair costs have not been identified with a specific weapon or support system.

The analysis in this study is based on a random stratified sample of 5,082 records with the Weapon or Support System Codes 997, 998, and 999. These data records were submitted by the services to OASD (MI&L)MD for work done in fiscal year 1983.

The results of this study suggests that while there may be problems with the interpretation of the guidance provided by DoD Instruction 7220.29-H, a viable system exists which could resolve these same interpretation problems and require less work on the part of the Services.

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I. INTRODUCTION

A. THESIS OBJECTIVE

The purpose of the research reported in this thesis is to examine and document the reasons why more than 40 percent of the fiscal year 1983 depot level repair costs have not been identified with a specific weapon system or support system. Under the current DoD cost accounting system outlined in the Department of Defense Depot Maintenance and Maintenance Support Cost Accounting and Production Handbook (DoD Instruction 7220.29-H), costs that cannot be identified with a particular weapon or support system are given a Weapon and Support System Code (WSSC) of either 997, 998, or 999. Using a representative sample of the data records identified with WSSC 997, 998 and 999, the research attempted to determine the following:

1. Why these costs are coded with WSSC 997, 998 or 999.
2. If all the services are following the guidance provided by DoD Instruction 7220.29-H.
3. If there are differences in interpretation of the guidance among the services.
4. Whether such a difference has any effect on the identification of costs with a weapon or support system.
5. Is there another system of identification that could better identify costs with a specific weapon or support system?

B. HISTORY OF THE PROBLEM

Department of Defense efforts began as early as 1963 to implement a standard cost accounting and reporting system that would apply to all depot level maintenance activities. Since 1975, the Office of the Secretary of Defense (Management Systems) has administered a uniform cost accounting and reporting system for all Department of Defense (DoD) depot maintenance activities as delineated in DoD Instruction 7220.29-H. This cost accounting system is designed to measure productivity, identify maintenance capacity, reduce duplication of effort and indicate potential areas for inter-service support of the maintenance workload. Further, it is designed to accumulate depot level maintenance costs by aircraft (F-14 Tomcat), ship (Destroyer), weapon system (AWG-9 air-to-air radar system) and weapon system component (AWG-9 radar waveguide). Costs are intended to be combined to give total costs for a particular program. For example, the repair costs for the AWG-9 radar waveguide should be traceable to the AWG-9 radar. Since the AWG-9 radar is only used in the F-14 aircraft, its costs should trace back to the F-14 aircraft. Adding all identified F-14 costs should give the total, yearly depot level maintenance expense for the F-14 program [Ref. 8].

However, all depot level maintenance costs cannot be traced to a unique weapon or support system. Only 60 percent of the total depot level maintenance costs could be identified

to a specific weapon or support system for fiscal year 1983. The rest of these costs for one reason or another were given a "miscellaneous" identification of either 997, 998, or 999.

C. SUMMARY

This thesis attempts to identify the reasons the different services have for giving an item a WSSC of 997, 998, or 999, and then discusses an alternative to the WSSC. Chapter II provides a brief history of the Uniform Cost Accounting system which eventually leads to a discussion of data record identification under DoD Instruction 7220.29-H, describing each Field and its function. Next, it considers Field 12 (WSSC) exclusively, concentrating on WSSC 997, 998, and 999 and the different services' interpretations of DoD Instruction 7220.29-H guidance for completing the field and the use of the three WSSCs. Chapter III contains the findings of this report, and Chapter IV states the conclusions, as well as suggesting improvements which might improve OASD's ability to capture all weapon and support system costs.

This study is merely one part of a larger ongoing study to evaluate depot level cost reporting to OASD.

II. MISCELLANEOUS ACCOUNTS

A. BACKGROUND

Historically, one of the difficult tasks in establishing the costs of a weapon system has been identifying the costs of maintaining that weapon system. Even at the depot level, where maintenance costs are most visible, it can be difficult to determine costs [Ref. 1: p. 8]. To compare the cost of similar work on the same types of items performed at different depots can also be difficult. Comparisons within and across services have been difficult to make due to the wide variety of accounting practices and procedures in use not only across services, but also within the individual services [Ref. 2: p. 8]. The lack of a uniform cost accounting system made interservice comparisons difficult and has stimulated studies by several government agencies. Studies in May, 1978 and April, 1981 by the General Accounting Office (GAO) and the Defense Audit Service (DAS) respectively, have pointed out that DoD has attempted, since as early as 1963, to establish a cost accounting and reporting system which would apply to all service depot level maintenance activities. A uniform system was deemed necessary so that the aggregated costs for repair, overhaul and maintenance activities would be meaningful [Ref. 2: pp. 7-8].

In 1972, the Office of the Assistant Secretary of Defense for Manpower, Reserve Affairs, and Logistics (now Manpower,

Installations, and Logistics) chartered the Joint Logistics Commanders (JLC) panel to promulgate a uniform depot maintenance cost accounting manual. On October 20, 1975, the results of the JLC's efforts were published as DoD Instruction 7220.29 "Guidance for Cost Accounting and Reporting for Depot Maintenance and Maintenance Support" and on October 21, 1975 as DoD Instruction 7220.29-H "Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting Handbook." The target date for implementation of this new system was October 1, 1976 [Ref. 2: p. 8].

Despite these significant efforts to implement the uniform cost accounting system, it is not fully implemented by all of the services and discrepancies in reporting still exist. Costs continue to be identified and accounted for on different bases among depots of the services [Ref. 2: p. 9].

The efforts to speed the installation and acceptance of a uniform cost accounting system are continuing. The JLC panel established the Joint Depot Maintenance Analysis Group (JDMAG) whose goal is to assure the elimination and/or explanation of costing inconsistencies between the services [Ref. 2: p. 9]. In March, 1980, the JLC Aeronautical Depot Maintenance Action Group was formed under permanent charter and continues to study the problem at hand. On September 5, 1984 a workshop was convened by OASD(MI&L) to discuss various system problems with representatives from the various services, JDMAG, and the Defense Manpower Data Center (which maintains

the depot level maintenance cost accounting data base) and to develop actions for consideration that could simplify and streamline the reporting system [Ref. 4].

B. OBJECTIVES OF THE REPORTING SYSTEM

The objectives of the reporting system as stated in DoD Instruction 7220.29-H are:

The principal objective of this Handbook is to establish a uniform cost accounting system for use in accumulating the costs of depot maintenance activities as they relate to the weapon systems supported or items maintained. The Handbook provides principles and procedures to assure uniform recordation, accumulation, and reporting....

The information provided by the cost system will assist in the measurement of productivity, the development of performance and cost standards and determination of areas for management emphasis...It will provide a means of identifying maintenance capability, duplication of capacity and indicate both actual and potential areas for interservice support of maintenance workload. [Ref. 3: p. 110-1]

The keywords are "uniform" and "identifying," and it is here that the problems lies. As stated before, the accounting for and identification of costs for a given task are not now, nor is it likely that in the foreseeable future they will be exactly alike. The accounting systems established by the services make it so. For example, the Air Force uses a process costing system while the other services use job order costing systems. The Army's system is centrally managed, while the other services are more decentralized. Regardless of the current differences among the services, the data reported to OASD by the services can be similar.

Without dictating one system that all services must adopt as their accounting and reporting system for depot level maintenance costs, the guidance given in DoD Instruction 7220.29-H allows each service to maintain their present system but expects certain cost information to be identified, extracted, and reported.

The data record specified in DoD Instruction 7220.29-H is the principle means of identifying and reporting the costs associated with the depot level maintenance performed on a piece of equipment, as well as controlling and accounting for the work performed. According to DoD Instruction 7220.29-H:

A data record is required for each type of depot maintenance work performed for a single customer at an individual activity on the same item or grouping of items permitted under the job order criterion....
[Ref. 3: p. 700-1]

Each data record represents one job order and indicates the total cost of the work completed on that job order. The record is made up of 50 fields of data. The first 16 fields provide the identification data for the record, the item or service provided, and the customer. The last 34 fields give a detailed breakdown of the costs and hours of manpower involved to perform the maintenance. Fields 9, 10, 12, and 13 provide the Item Identification Number (IID), the Item Nomenclature, Weapon or Support System Code (WSSC), and the Work Breakdown Structure Code (WBS) respectively, for the item being maintained. These four fields identify the type of equipment that was maintained at a depot.

C. PURPOSE OF RESEARCH

The purpose of the research reported in this thesis is to examine and document the reasons why more than 40 percent of the Fiscal Year 1983 depot level maintenance costs have not been identified with a specific weapon or support system. Specifically, this thesis presents a study of the status of the equipment identifiers in Fields 9, 10, 12, and 13 as they are currently being used by the services. The emphasis is on WSSCs 997, 998, and 999 in Field 12. The thesis examines Field 12 in depth, how it is interpreted by the different services, and why particular Weapon or Support System Codes are assigned. The following specific questions are investigated:

What do codes 997, 998, and 999 mean?

What does each of the codes identify?

Which of the services use the codes?

How much in actual costs is "lost" within these identifiers? If the costs cannot be identified with a specific weapon or support system they are "lost." The costs are "lost" in a large pool from which little significant information can be gained. What can be done to avoid the use of these three "miscellaneous" WSSCs is also discussed. The results of this study are part of a larger study to evaluate the import of the depot level cost accounting and reporting system to OASD(MI&L).

D. IDENTIFYING THE EQUIPMENT BEING MAINTAINED

The purpose of this section is to explain how each item being maintained and reported on a data record can be identified. One of the objectives of the cost accounting system is to provide depot level cost information to the managers and individuals not immediately involved with depot level maintenance facilities. Optimally, upon request the data base should be able to provide, for example, the total 1983 maintenance costs for all F-4 aircraft throughout the services, or by service, or by depot, or other possible permutations of data. If the user is interested in a specific weapon system or support system, the present uniform cost accounting system delineated in DoD Instruction 7220.29-H provides four Fields to identify a system: Fields 9, 10, 12, and 13. The following sections describe each of these four fields. Each section provides a summary of the guidance provided by DoD Instruction 7220.29-H.

1. Item Identification Number

Field 9 is the Item Identification number (IID), the code that identifies the specific item on which depot maintenance was performed. There is space in this field to insert the National Stock Number (NSN) of the item, and DoD 7220.29-H allows other identifying numbers to be used as well. For example:

If an item is an aircraft, an aircraft or rocket engine, or a missile, show the type, model, and series ...If the item is a vessel, show ship type and hull number.... [Ref. 3: pp. 700-7, 700-8, 700-9]

Examples may be 5840004894799 for the NSN, or F4S for an aircraft, or DD963 for a vessel.

2. Item Nomenclature

The next field, Field 10, is the Item Nomenclature. This is a 20 digit field, describing the specific item on which maintenance was performed, or the support service that was performed. In the case of an aircraft or missile, the popular names, if assigned, should be used (e.g., LIFTMASTER, PHANTOM). If a popular name is not assigned then the basic mission of the aircraft or missile should be used (e.g., Fighter Aircraft, Air Ground Missile, Helicopter). For vessels, the name of the ship type is used: FBM SUB, MINESWEEPER OCEAN, GUIDED MISSILE FRIGATE. For items with an NSN, the description carried in the Federal Supply catalog should be used.

3. Weapon and Support System Code

Field 12 is the Weapon or Support System Code (WSSC). Again, this code identifies a specific weapon or support system. The existing coding systems now used by the DoD components for depot maintenance reporting are to be inserted in this field. In the event that an item cannot be specifically identified and assigned the corresponding WSSC, DoD Instruction 7220.29-H provides three miscellaneous codes. The first is code 997 is to be used if an item cannot be identified to a specific weapon or support system, but can be identified to a major commodity group and category (e.g.,

Aircraft-Fighter, Electronics and Communications Systems-Radio). Code 998 is to be used when only the commodity group can be identified (e.g., Aircraft, Missiles, Ship). Code 999 is to be used if identification cannot be made to either a major commodity group or category.

According to the minutes of the DoD 7220.29-H Work Shop held 5-7 September 1984, the guidance for Field 12 concerning the use of 997, 998, and 999 is confusing, because there is more than one interpretation. It was recommended at the Work Shop that WSSCs 997 and 998 be eliminated because these codes cause confusion and inaccuracy. OASD (MI&L)MD is currently considering a new policy to implement this change [Ref. 4].

4. Work Breakdown Structure Code

Field 13 is the Work Breakdown Structure code (WBS). The Work Breakdown Structure is the code for the commodity group and category applicable to the item described in Fields 9 and 10.

There are three levels or positions that make up the WBS code. The first position describes the commodity group (e.g., Aircraft, Automotive Equipment, Combat Vehicles, Ships, Electronics and Communications Equipment). The second position describes the category of the commodity group. For example, in the case of the commodity group Aircraft the categories are: Fighters, Bombers, Transport, Trainers, Utility, Attack, Patrol, Antisubmarine, or Other. The third

position describes a system that is part of that category. In the case of Aircraft Fighter the third position could be one of the following: Airframe, Engine, Electronics and Communications Equipment, Armament.

5. Summary

This section is meant to provide a better understanding of the amount of detail required by DoD Instruction 7220.29-H to identify an item receiving depot maintenance. Fields 9, 10, and 13 are referred to later in the thesis, particularly when describing the findings, conclusions, and recommendations. In the next sections the perceived problems with Field 12, the WSSC, are discussed, since this is the field that ultimately identifies a "miscellaneous" account.

E. DIFFERING INTERPRETATIONS

The purpose of Field 12 is to provide a common identifier for each weapon or support system. Presently the guidance provided for Field 12 in DoD 7220.29-H is confusing and has been interpreted differently by each of the services [Ref. 4]. These varying interpretations have come as the result of three questions or areas of confusion concerning the guidance. The first area of confusion discussed is the different definitions of a weapon or support system used by the services. Second, is the various WSSC coding systems used by the services, to support the question, "Which code do we use?" The last area of confusion discussed deals with the varying interpretations of WSSC 997, 998, and 999.

1. Weapon System Definition

DoD Instruction 7220.29-H Appendix C provides the following definitions of Weapon System and Support System:

Weapon System: A final combination of subsystems, components, parts and materials which make up an entity utilized in combat, either offensively or defensively, to destroy, injure, defeat, or threaten the enemy; e.g., F-4 aircraft, FB, surmarine, frigate, HAWK missile installation, Huey Cobra Helicopter (DoDD 4151.16).

Support System: A final combination of subsystems, components, parts, and materials which make up an entity utilized in support of military missions, e.g., fleet oiler, transport aircraft, submarine tender, communications systems. [Ref. 3: p. C-5]

At the present time each of the services has their own interpretations of what constitutes a weapon system. This can be seen by looking at the Defense Logistic Agency's (DLA) weapon system support program. In order for a specific weapon system to be included in this program, a service must request DLA to include that system in the program, and assign the system a Weapon System Code. It is up to the service to include a weapon system in this program. There does not seem to be an obvious reason why a weapon system would not be included in this program. Currently, the number of weapon systems identified within the DLA system include 130 systems designated by the Navy, 173 by the Army, 149 by the Air Force and 274 by the Marine Corps. The listing of DLA weapon system codes shows some inconsistency in the definition of a weapon system by the four DoD components. For instance, the Marine Corps has included the AN/PRC-77 radio set among their designated weapon systems but neither the Army nor the

Navy have included this system although both services use the radio set. The number of systems designated by the service varies directly with the amount of detail involved in that service's weapon system listing with DLA. The Marine Corps and the Army have listed everything from gas masks to test sets to tanks, while the Navy and Air Force have only listed their particular aircraft, aircraft engines, vehicles, and in the case of the Navy, some shipboard weapon systems. The Navy has designated general categories for systems such as gun systems, communication and data systems, and combat system support equipment. The Air Force has listed the support equipment for each individual type of aircraft separately (e.g., Support Equipment, F-4 Aircraft). As stated above, there appears to be no consistency between services regarding the definition of a weapon system. Is the aircraft the weapon system? Or, are the systems that make up that aircraft (e.g., the radar, radio, missiles, guns) the weapon systems?

2. Which Code to Use

DoD Instruction 7220.29-H directs the services to use their existing coding systems for reporting depot level maintenance in Field 12 for the WSSC [Ref. 3: p. 700-10]. However, all of the existing coding systems are different. For example the Navy uses a number of coding systems dependent on various conditions to identify weapon systems and weapon support systems. If the type, model, and series of an

aircraft is identified in Field 9 (IID), 1111 will be entered in Field 12 (WSSC). When the ship type and hull number is identified in Field 9 and all three levels of the WBS code are identified, then 2222 will be entered in Field 12. Otherwise, the existing cost account coding system, from NavCompt Manual 024640, or the 3-M Aviation Type Equipment Coding system, from NavCompt Manual 024640-2d(3), will be entered. In all other instances, codes 997, 998 or 999 will be used. The criteria for assigning these codes are the same as those contained in DoD Instruction 7220.29-H [Ref. 5]. The other service components have similar instructions describing their interpretations of DoD Instruction 7220.29-H.

The Army has Army Regulation 37-55 which states that the U.S. Army Depot Services Command (DESCOM) will send an annual computer printout of active weapon/support system identification codes to all materiel readiness commands' points of contact. This regulation also states that WSSC 998 should have very limited use and that it should be used only when there is no practical method to identify items or services to a system of the equipment category. Army Regulation 37-55 also states that WSSC 999 should only be used with commodity groups [Ref. 6: pp. A-1, A-2].

The Air Force has AFR 177-7 "Depot Maintenance and Maintenance Support Cost Accounting and Production Reporting," a one page implementation instruction that directs the use

of DoD Instruction 7220.29-H as guidance for depot level maintenance reporting.

3. What Does 997, 998 and 999 Mean?

The following statement from DoD Instruction 7220.29-H has created some confusion.

Code 997 shall be used if an item cannot be identified to a specific weapon or support system, but can be identified in Field 13 to a major commodity group...and to a category...within the major commodity group. Code 998 shall be used if identification is possible only to a major commodity group and not to a category. Code 999 shall be used if identification cannot be made to a major commodity group....
[Ref. 3: p. 700-10]

The statement may seem very clear to the reader at first glance, but as discussed earlier, there are at least two interpretations of this statement. One interpretation is that the three codes should be used if the item cannot be identified to a specific weapon system or support system because the person making the classification does not know to which weapon or support system the item belongs (e.g., a radio that came out of a particular aircraft). The other interpretation is that the three codes should be used if an item, the radio, may be identified with a number of different types of aircraft, even though this particular radio is known to have come from a specific aircraft. These two interpretations will make a difference in the way the records are classified.

Ideally, the quickest way to retrieve cost data relating to a specific weapon or support system would be by

using the WSSC. However, at the present time it is impossible to retrieve all the cost data for a system because of the different interpretations of Field 12 guidance.

F. PERCENTAGE OF DATA IN 1997, 1998 AND 1999

The number of data records with WSSCs of 1997, 1998, and 1999 in Field 12 represent over 65 percent of the records submitted by the Services for Fiscal Year 1983 (see Table II-1). These records had a combined actual cost associated with them of over \$5.3 billion (see Table II-2). This is approximately 41 percent of the total reported actual cost for depot level maintenance in Fiscal Year 1983.

G. SUMMARY

This chapter has discussed the different interpretations of the guidance provided by DoD Instruction 7220.29-H for identifying the costs associated with the depot level maintenance of an item. The DoD Instruction as it concerns Field 12 is confusing and results in interpretations of the coding for Field 12. Regardless of the differing interpretations, if one depot is able to identify a data record with a specific weapon or support system then all depots should be able to specifically identify the same data record with a weapon or support system. In the next chapter the question of how many of the item records coded 1997, 1998, and 1999 could be recoded to a specific weapon or support system, given that same item had been specifically coded on another record, is investigated.

TABLE II-1

PERCENTAGE OF 997, 998, 999 RECORDS SUBMITTED

Service:	Total Records Submitted	997	WSSC 998	999	Total	Percentage
Army	9,523	0	2,166	123	2,289	24.0
Air Force	48,574	1,769	24,308	8,288	34,365	70.7
Navy/MC	32,796	1,642	17,201	4,381	23,224	70.8
Totals	90,893	3,411	43,675	12,792	59,878	65.9

TABLE II-2

PERCENTAGE OF TOTAL COSTS ASSOCIATED
WITH 997, 998, AND 999 RECORDS

Service:	Costs of Total Records Submitted (\$000,000)	Costs of 997,998,999 Records Submitted (\$000,000)	997,998,999 Records as a Percentage of Total Cost
Army	1,255	277	22.1
Air Force	4,975	2,074	42.0
Navy/MC	2,030	3,025	43.0
Totals	13,260	5,376	40.6

III. RESEARCH METHODS AND FINDINGS

A. SAMPLE SELECTION

A sample was taken to test the question of how many data records coded 997, 998, and 999 could be recoded to a specific weapon or support system given that the same item had been specifically coded on another record. There were 59,878 data records of depot level maintenance actions with WSSC 997, 998, or 999 submitted to OASD (MI&L)MD for Fiscal Year 1983. The population had the following characteristics. The total actual costs per data record ranged from \$0 to over \$50.0 million, with the histogram of the population resembling a normal distribution, its median being within the \$1,001 to \$10,000 range. Using a simple random sample of this population could have misrepresented the population by developing a sample comprised of a disproportionate number of records from some range of the population's costs. With such a wide range of total costs, a stratified sample would best represent this population. In this case, a stratified sample relating proportional allocation on the basis of total cost dollars was chosen. Such a sample captures all dollar values and allows representation in the sample based on the number of data records per dollar value in the population.

The population was organized into the following strata:

\$Zero
 \$1 - 10
 \$11 - 100
 \$101 - 1,000
 \$1,001 - 10,000
 \$10,001 - 100,000
 \$100,001 - 1,000,000
 \$1,000,001+

Table III-1 is a frequency distribution displaying the number of records by service and WSSCs 997, 998, or 999 by strata. The stratified random sample was drawn to satisfy the following criteria:

1. A 95 percent confidence level of estimating the true value of the proportion of records identified with a specific weapon or support system.
2. Sampling error permitted of plus or minus 5 percent in estimating the true proportion of records identified with a specific weapon or support system.
3. Estimated true proportion of records identified with a specific weapon or support system of 50 percent.

It was decided to overestimate the sample size and act conservatively, by assigning the probability of success of .50 or 50 percent. Equation 1 was used to calculate the sample size necessary to estimate the mean given the three criteria listed above:

Equation 1:

$$n_0 = \frac{z^2 p(1-p)}{e^2}$$

$$n_0 = \frac{(1.96)^2 \times .50(1-.50)}{(.05)^2}$$

$$n_0 = 384.16 \quad [\text{Ref. 6: p. 269}]$$

TABLE III-1

1983 DOLLAR DISTRIBUTION BY WSSC

WSSC 997

Actual cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	22	3	25
1 to 10	0	1	1	2
11 to 100	0	35	22	57
101 to 1,000	0	412	148	560
1,001 to 10,000	0	723	383	1,106
10,001 to 100,000	0	438	491	929
100,001 to 1,000,000	0	126	448	574
1,000,001+	0	12	146	158
Total	0	1,769	1,642	3,411

WSSC 998

Actual cost (\$)	Army	Air Force	Navy/MC	Total
Zero	40	91	14	145
1 to 10	1	46	83	130
11 to 100	28	695	868	1,591
101 to 1,000	395	7,494	4,428	12,317
1,001 to 10,000	708	9,301	6,697	16,706
10,001 to 100,000	601	4,687	4,151	9,439
100,001 to 1,000,000	342	1,737	896	2,975
1,000,001+	51	257	64	372
Total	2,166	24,308	17,201	43,675

WSSC 999

Actual cost (\$)	Army	Air Force	Navy/MC	Total
Zero	2	9	27	38
1 to 10	0	11	13	24
11 to 100	0	686	279	965
101 to 1,000	38	3,726	1,257	5,021
1,001 to 10,000	50	2,474	1,510	4,034
1,001 to 100,000	23	983	916	1,922
100,001 to 1,000,000	10	320	275	605
1,000,001+	0	79	104	183
Total	123	8,288	4,381	12,792

TOTALS

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	42	122	44	208
1 to 10	1	58	97	156
11 to 100	28	1,416	1,169	2,613
101 to 1,000	433	11,632	5,833	17,898
1,001 to 10,000	758	12,498	8,590	21,846
10,001 to 100,000	624	6,108	5,558	12,290
100,001 to 1,000,000	352	2,183	1,619	4,154
1,000,001+	51	348	314	713
Total	2,289	34,365	23,224	59,878

The sample size of 384 does not reflect the size of the population. Once n_0 has been computed it must be subjected to a correction factor (Equation 2) which determines the proper sample size (n) for the total population of a strata (N).

Equation 2:

$$n = \frac{\frac{n_0}{n_0 + (N-1)}}{N} \quad [\text{Ref. 6: p. 274}]$$

For example, to determine the required sample for the \$100,001 to \$1,000,000 strata for WSSC 998, the total population of that strata is determined. That population value (N) of the strata (i.e., 2,975) is placed in Equation 2 to determine the required total sample size for that strata. In this case the total sample required is 340 data records. To determine the required number of data records that must be sampled for each service in a particular strata, the original proportion of the service population for a particular strata is multiplied times the strata's total sample size. The results of these calculations are shown in Table III-2. They resulted in a total sample size of 5,082 data records or approximately 8.5 percent of the population. Given the required size of the sample for a particular cell, the samples were then randomly chosen from the total population within a cell of the strata (e.g., a random sample of 39 Army 998 data records with a total actual cost between \$100,001 and \$1,000,000 was selected).

TABLE III-2

SAMPLE DISTRIBUTION BY WSSC AND DOLLAR VALUE

WSSC 997

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	21	3	24
1 to 10	0	1	1	2
11 to 100	0	31	19	50
101 to 1,000	0	168	60	228
1,001 to 10,000	0	186	99	285
10,001 to 100,000	0	128	144	272
100,001 to 1,000,000	0	50	180	230
1,000,001+	0	9	103	112
Total	0	594	609	1,203

WSSC 998

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	29	66	10	105
1 to 10	1	34	62	97
11 to 100	5	135	170	310
101 to 1,000	12	227	134	373
1,001 to 10,000	16	209	151	376
10,001 to 100,000	23	183	163	369
100,001 to 1,000,000	39	199	102	340
1,000,001+	26	131	32	189
Total	151	1,184	824	2,159

WSSC 999

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	2	8	25	35
1 to 10	0	11	12	23
11 to 100	0	195	80	275
101 to 1,000	3	265	89	357
1,001 to 10,000	4	215	132	351
10,001 to 100,000	4	164	152	320
100,001 to 1,000,000	4	124	107	235
1,000,001+	0	54	70	124
Total	17	1,036	667	1,720

TOTALS

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	31	95	38	164
1 to 10	1	46	75	122
11 to 100	5	361	269	635
101 to 1,000	15	660	283	958
1,001 to 10,000	20	610	382	1,012
10,001 to 100,000	27	475	459	961
100,001 to 1,000,000	43	373	389	805
1,000,001+	26	194	205	425
Total	168	2,814	2,100	5,082

B. ANALYSIS

To identify the data records that could be more specifically identified, the sample was compared to the entire population by Item Identification Number (IID). Whenever one of the sample IIDs appeared two or more times the record was printed out. The resultant printout was then examined and the number of records that had been more specifically identified was recorded.

As presented in Table III-3, 228 of the 5,082 data records sampled had been specifically identified. The 228 records represented 1.4 percent of the costs associated with the sample. Based on the results of this test approximately \$80 million in the total population could have been specifically identified to a weapon or support system.

Probably more important than the test result were other issues that became evident. This led to other avenues of investigation, and other reasons were found for over 40 percent of depot level maintenance costs (see Table II-2) being unidentifiable with a specific weapon or support system. The balance of the chapter discusses these issues.

C. OTHER PROBLEMS

1. Naval Ship Depot Level Maintenance

Of the costs associated with WSSC 997, 998, and 999 records, the Navy had 31.5 percent of the total \$5.3 billion, or \$1.7 billion, associated with their 997 records. The majority of the costs in the Navy's 997 records involved

TABLE III-3

RESULTS OF SAMPLE TESTING
DISTRIBUTION BY WSSC AND DOLLAR VALUE

WSSC 997

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	0	0	0
1 to 10	0	0	0	0
11 to 100	0	0	0	0
101 to 1,000	0	0	5	5
1,001 to 10,000	0	0	5	5
10,001 to 100,000	0	3	7	10
100,001 to 1,000,000	0	1	11	12
1,000,001+	0	0	1	1
Total	0	4	29	33

WSSC 998

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	0	1	1
1 to 10	0	0	4	4
11 to 100	0	0	6	6
101 to 1,000	0	3	16	19
1,001 to 10,000	4	4	19	27
10,001 to 100,000	3	3	21	27
100,001 to 1,000,000	5	5	12	22
1,000,001+	4	1	5	10
Total	16	16	84	116

WSSC 999

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	0	1	1
1 to 10	0	0	4	4
11 to 100	0	0	3	3
101 to 1,000	0	1	12	13
1,001 to 10,000	0	4	14	18
10,001 to 100,000	0	8	10	18
100,001 to 1,000,000	0	9	11	20
1,000,001+	0	2	0	2
Total	0	24	55	79

TOTALS

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	0	0	2	2
1 to 10	0	0	8	8
11 to 100	0	0	9	9
101 to 1,000	0	4	33	37
1,001 to 10,000	4	8	38	50
10,001 to 100,000	3	14	38	55
100,001 to 1,000,000	5	15	34	54
1,000,001+	4	3	6	13
Total	16	44	168	228

TABLE III-4

TOTAL COSTS ASSOCIATED WITH TABLE III-3 BY SERVICE

Actual Cost (\$)	Army	Air Force	Navy/MC	Total
Zero	\$ 0	\$ 0	\$ 0	\$ 0
1 to 10	0	0	50	50
11 to 100	0	0	523	523
101 to 1,000	0	2,366	16,518	18,876
1,001 to 10,000	12,795	31,761	168,854	213,410
10,001 to 100,000	44,595	557,852	1,182,256	1,784,703
100,001 to 1,000,000	1,364,759	3,583,548	8,963,339	13,911,656
1,000,001+	9,411,726	4,202,029	13,507,561	27,121,316
TOTAL	\$10,833,885	\$8,377,556	\$23,839,093	\$43,050,534

TABLE III-5

TECHNICAL ASSISTANCE, NON-MAINTENANCE WORK, ETC., DATA RECORDS

Service:	# of Records	Total Cost (\$000,000)
Army	72	32
Air Force	100	35
Navy/MC	109	412
TOTAL	281	479

those costs associated with depot level maintenance of ships. From the sample taken, 377 of the 609 data records sampled represented depot level maintenance of ships with associated costs of \$810 million. This was 59 percent of the costs of the Navy 997 records sampled (\$1.4 billion), or, in other words, generalizing to the total population 19 percent of the costs associated with the 997, 998, and 999 records.

The present policy of the Navy with regard to Field 12, as promulgated in NavCompt Instruction 7310.9D and DoD Instruction 7220.29-H, requires the use of WSSC 997 when the third position of the WBS (i.e., the weapon or support system) cannot be identified. Examples of the third position are: Hull Structure, Electric Plant, Auxiliary System, Armament. If a ship is in overhaul or receiving depot level maintenance there are usually any number of these systems receiving maintenance actions. Since these data records represent the cumulative costs for the depot level maintenance on the entire ship and not just one specific system, only the first two positions or levels of the WBS can be completed correctly, because one specific system cannot be identified. The first two positions of the WBS identify first that it is a ship receiving depot level maintenance and the second position identifies the type of ship, e.g., Battleship, Cruiser, Carrier, Destroyer. Therefore because only the commodity group (ship) and the category (Destroyer) can be identified it is given the WSSC 997 rather than a specific WSSC as is suggested by the definitions found in Appendix C of DoD Instruction

7220.29-H. However, given that Field 9 is the hull number of the ship, the cost of the major weapon system (i.e., the ship) is identified. To reiterate the Naval Ship Depot Level Maintenance accounts for 19 percent of the total costs in the 997, 998, and 999 categories. Given that Field 9 identifies the ship, costs can be attached to a major weapon system regardless of the Field 12 coding.

2. Naval Air Rework Facility Component Rework

When DoD Instructions 7220.29 and 7220.29-H were first promulgated, the six Naval Air Rework Facilities held a meeting in 1975 to decide how to extract the required data from their own cost accounting systems. It was found that manual intervention was frequently necessary. This resulted in an agreement to code all component rework either 997, 998, or 999, to reduce the workload to a manageable level. Although not written policy, it has been the procedure used by NARF [Ref. 8].

3. Interservicing

Law found that in 1983 there were approximately 3,000 data records coded with WSSCs 997, 998, or 999 as a result of depot maintenance interservicing [Ref. 9]. This occurred because the service performing the depot level maintenance did not regard that item as a weapon system or was not able to identify the item with a system. The item was then coded appropriately with either 997, 998, or 999. This is true for all services performing depot maintenance interservicing.

4. Technical Assistance and Non-maintenance Work

Depots from all four service components supply technical assistance in one form or another. Of the 5,082 data records sampled, there were 281 records which fell in this category. These data records had Item Nomenclature such as: Technical Assistance, Non-maintenance Work, Program and Planning Support, Maintenance Technical and Engineering Support, Technical and Engineering Data. These Item Nomenclatures are defined in Appendix E of DoD Instruction 7220.29-H. The 281 data records accounted for \$479 million, or 16.4 percent of the total costs associated with the same (Table III-5).

None of these records had an identifier that could aid in the task of specifically identifying these costs with a particular system. Some did have the Federal Supply Class 4-digit code, but this was only used in 72 of the 281 cases. The other 209 records carried either no IID, or a locally prepared IID that does not follow the guidelines set down in DoD 7220.29-H.

5. Different Interpretations

As discussed above, one of the interpretations of the guidance for completing Field 12 provided by DoD Instruction 7220.29-H is that WSSCs 997, 998, or 999 should be used because a part or subsystem of a weapon or support system may be identified with a number of different weapon or support systems, even though the particular part of subsystem is known to have come from a specific weapon or support system.

For instance, it is possible that a portion of the Air Force 997, 998, and 999 records may be attributed to this difference in interpretation of the guidelines for Field 12 given the operating system of the Air Force. The Air Force is the only service that uses a process costing system to accumulate all associated costs. Also each facility or shop is specialized and performs maintenance on a particular type of aircraft or components, the majority of the depot level maintenance accomplished is in batches. Performing maintenance on batches of the same item does not lend itself well to identification with a specific weapon system, such as a Fighter with a particular tail number. On the other hand the Navy uses a detailed job costing system which bases identification of a specific aircraft on a specific tail number which should make identification with a specific weapon system easier. The population data supports this argument. The Air Force had 42 percent of the costs associated with depot level maintenance classified as 997, 998, or 999, while the Navy had 31.5 percent, net of the percentage identifiable to ships, classified as 997, 998, or 999.

There is not only a difference in interpretations between services, but also within services. The sample includes examples of as many different WSSCs being assigned to an item as there are facilities performing maintenance on the item. One facility may assign an item a WSSC of 997, another 999, while still another may assign a specific

code. This not only displays an inconsistency in the interpretation of DoD Instruction 7220.29-H, but also an inconsistency in the interpretation of the individual service's implementation instruction.

D. SUMMARY

Approximately 72 percent of the 997, 998, and 999 records are accounted for by the findings associated with:

1. The matching of 997, 998, and 999 records
2. Naval ship depot level maintenace
3. Naval Rework Facility component rework
4. Interservicing
5. Technical assistance and non-maintenance work
6. Different interpretations

Other possible explanations exist for the balance of the 59,878 data records. For instance, though not prove, there is reason to believe that a portion of these records were given the WSSC 997, 998, or 999 because by assigning one of those WSSCs, the record would "get through the system." For example, if a data record was returned for error correction, a simple way to get the record off the desk, out of the office, and back in the system is to assign a WSSC of 997, 998 or 999.

IV. CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the findings of the study and offers recommendations for system improvements or areas where it is felt that further study is required.

A. CONCLUSIONS

As stated at the outset, the reason for conducting this study was to determine why over 40 percent of the total costs for depot level maintenance had not been identified with a specific weapon or support system. A review of a representative sample of the data records with WSSC 997, 998, and 999, revealed that all the services are following guidance set forth in DoD Instruction 7220.29-H. No evidence was uncovered to indicate the contrary. The problem and primary reason for over 40 percent of the costs appearing in "miscellaneous accounts" is that the guidance for Field 12 is imprecise and open to interpretation by each of the services. The research conducted for this thesis found that 72 percent of the records associated with WSSC 997, 998, and 999 can be accounted for by the imprecise guidance provided for Field 12. To insure that the costs are identified with a specific system, the instruction should provide more specific guidance that either does not require interpretation by each service.

1. Weapon System Definition

There is confusion about, and different interpretations of, the definition of a specific weapon or support system. DoD Instruction 7220.29-H Appendix C provides definitions for each, a weapon system and a support system, the definitions should not require interpretation by the services. (However, regardless of whether the definitions are unequivocal or not, the use of the Special Material Identification Code and Material Management Code discussed below will enable appropriate identification.) Based on these definitions, Field 12 and the WSSC appear to be unnecessary in the case of an equipment end-item. Unnecessary because the information required to identify an equipment end-item as a weapon system or support system is given in Fields 9, 10, and 13, the Item Identification Number, Item Nomenclature and Work Breakdown Structure respectively. An equipment end-item, also defined in Appendix C, is the final combination of assemblies, parts, and materials which together perform a complete operational function and is ready for its intended use (i.e., a vehicle, missile, aircraft, ships, tank, communication system) [Ref. 3: p. C-2]. An example of this is reporting a maintenance action on the airframe of an F-14A. According to the guidance set forth in DoD Instruction 7220.29-H, Field 9 would say F-14A, Field 10 would say "Tomcat" and Field 13 would say All, which means Aircraft Fighter Airframe.

Identifying equipment end-items is only a small part of the issue, the larger part deals with identifying components and subsystems with these equipment end-items. Components and subsystems are not as easily identifiable. However, the discussion in the next section provides a means to identify at least a portion of the weapon system components and subsystems.

2. Which Code to Use

Identifying the costs associated with equipment end-items is not the only area of the DoD Instruction that causes confusion and inconsistency in the system, another is the freedom given to each service to use existing coding systems for depot maintenance reporting when submitting reports to OASD. No two services use the same code. A problem arises in the reporting of component or subsystem maintenance and rework. Some services can specifically identify a component with a code, and therefore a weapon or support system, while others cannot. A standardized coding system for all services would provide confidence that all the services are identifying costs of component rework with the specific weapon or support system. Such a system has been identified within the Navy and the Air Force that could serve that purpose.

The system requires capturing the two characters following the National Item Identification (NIIN) of the National Stock Number (NSN). These two characters are identified in the Navy as the Special Material Identification

Code (SMIC) and in the Air Force as the Material Management Code (MMC). Vandivort conducted research into the use of the SMIC by the Naval Air Rework Facilities as a solution to identifying the costs of component rework. His thesis was a case study of the F-14A at NARF, North Island [Ref. 8]. Since the SMIC or MMC is a part of the NSN, there is little reason to believe that the recommendations for the use of the SMIC by Vandivort could not be extended to all of the services. All equipment end-items could then be identified by using Fields 9, 10 and 13, the components and subsystems could be identified using the "SMIC" or "MMC." For items such as Technical Assistance or Non-maintenance Work, that cannot be associated with a specific system, a code of "99" could be assigned for use by all services. The "SMIC" or MMC" could be placed in Field 12.

B. RECOMMENDATIONS

The following recommendations are based on the aforementioned conclusions:

RECOMMENDATION 1: The guidance for completing Field 12 by DoD Instruction 7220.29-H should be revised. The revision should require the use of Field 12 only if all positions of Fields 9, 10, and 13 cannot be completed.

RECOMMENDATION 2: The definitions in DoD Instruction 7220.29-H for a Weapon System and a Support System should be the only acceptable definitions for and should be the bases for the services interpretation of whether an end-item

is a weapon system or not. This would provide comparability of weapon and support systems across services.

RECOMMENDATION 3: Further study should be conducted into the use of the Special Material Identification Code or Material Management Code as an alternative means of identifying component with the appropriate weapon system.

C. SUMMARY

In conclusion, this study attempted to determine the reason for over 40 percent of the actual costs associated with depot level maintenance being unidentifiable with a specific weapon or support system. The study suggests that while there may be problems with the interpretation of the guidance provided by DoD Instruction 7220.29-H, a viable system exists which could resolve these same interpretation problems and require less work on the part of the service components.

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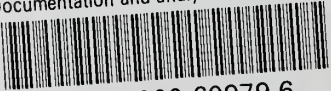
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